UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/506,375	09/02/2004	Andries Pieter Hekstra	NL 020183	1197

24737 7590 05/31/2006

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
P.O. BOX 3001
BRIARCLIFF MANOR, NY 10510

EXAMINER	
CHAUDRY, MUJTABA M	
ART UNIT	**PAPER NUMBER**
2133	

DATE MAILED: 05/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/506,375	HEKSTRA ET AL.
	Examiner	Art Unit
	Mujtaba K. Chaudry	2133

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 March 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *9* is/are allowed.

6)☒ Claim(s) *1-8 and 10-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/23/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Applicants' response was received March 23, 2006.

- **Claims 1-8 and 10-12 remain rejected.**
- Claim 9 is allowed.
- Corrections to Figures 1-3 showing prior art label are accepted.
- **The Abstract remains objected to because it remains more than 150 words.**
- The subheadings of the specification are accepted.
- Rejections under 35 USC 112 are withdrawn in view of Applicants' arguments and amendments.
- Newly submitted IDS is considered.

Application pending.

Response to Amendment

Applicants' arguments/amendments with respect to amended claims 1-8 and 10-12 filed March 23, 2006 have been considered. All arguments have been fully considered but are not persuasive. The Examiner would like to point out that this action is made final (See MPEP 706.07a).

Applicants contend, "...Kumar (prior art of record) does not teach or suggest forming differences of a number of pairs of possibly mutilated code words..." The Examiner respectfully disagrees. The Examiner's interpretation of this limitation, in accordance with MPEP 2111, is to form difference between at least two code words, since "a number of pairs" can refer to 1 or

more and pair(s), since 1 is a number. Therefore with this interpretation, Kumar teaches (col. 31, lines 1-17) the number of differences in bit positions (i.e. the Hamming distance) between each of the re-encoded estimates and the corresponding received estimate prior to decoding and re-encoding, is approximately proportional to the bit error rate (BER) for the codeword prior to decoding. **When the determined BER estimates for the two codeword estimates are substantially different, the receiver system selects the decoded codeword from the pair with the lower BER** (smaller Hamming distance) for propagation as the most probable source bit information for that codeword.

The Examiner disagrees with the Applicant and maintains rejections with respect to amended claims 1-8 and 10-12. All arguments have been considered. It is the Examiner's conclusion that amended claims 1-8 and 10-12, as presented, are not patentably distinct or non-obvious over the prior art of record. See prior action:

Specification

The disclosure is objected to because of the following informalities:

Applicant is reminded of the proper language and format for an abstract of the disclosure.

> ***The abstract should be in narrative form and generally <u>limited to a single paragraph on a separate sheet within the range of 50 to 150 words.</u> It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.***
>
> ***<u>The language should be clear and concise and should not repeat information given in the title or claim(s)</u>. It should avoid using phrases which can be implied, such as, "The***

disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The abstract of the disclosure is objected to because it is not in conformance with the requirements stated in the MPEP. Applicants are suggested to rewrite the abstract using the information stated above including limiting the abstract to a single paragraph and not more than 150 words. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-8 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar (USPN 6246698) further in view of Yonge (USPN 6289000).

As per claim 1, Kumar substantially teaches a digital data transmission system wherein redundant source bit information is transmitted in both the upper and lower sidebands so that the loss of information in either one but not both sidebands due to large amounts of interference or distortion, caused by, for example, first-adjacent interference, does not deleteriously affect the IBOC DAB receiver performance. The system exhibits both frequency-diversity and time-diversity. The receiver determines which codeword bit estimate, corresponding to either upper or lower sideband signals, is less likely to be erroneous. The receiver system selects between

decoded estimates for each pair of demodulated ECC codewords or combines both ECC codeword estimates prior to decoding in certain embodiments. Particularly, Kumar teaches (cols. 30-31) that for each pair of received codeword estimates, the receiver system combines codeword estimates or selects between decoded codeword by determining a metric which corresponds to the probability of error in each of the decoded codeword estimates. In certain embodiments, the metric is computed by ECC decoding some or all of the bits for both received codeword estimates and then re-encoding the two decoded estimates to re-generate the pair of ECC codewords. The number of differences in bit positions (i.e. the Hamming distance) between each of the re-encoded estimates and the corresponding received estimate, prior to decoding and re-encoding, is approximately proportional to the bit error rate (BER) for the codeword prior to decoding. When the determined BER estimates for the two codeword estimates are substantially different, the receiver system selects the decoded codeword from the pair with the lower BER (smaller Hamming distance) for propagation as the most probable source bit information for that codeword. In certain embodiments of the receiver, when the BER estimate is substantially equal for both codewords in each pair, the codeword estimates are combined in order to increase the signal-to-noise ratio (SNR) since the redundant contributions add approximately coherently and the noise contributions add approximately incoherently. In this circumstance, the combined codeword estimate is then ECC decoded to generate the source bit message estimate for the codeword. Since the error metrics are not determined until after first decoding the upper and lower codewords separately, this requires a second decoding step. In certain embodiments of the invention, instead of determining the error metric by comparing the bit differences between the codeword and re-encoded codeword estimates after ECC decoding, when convolutional

encoding is implemented with maximum-likelihood Viterbi decoding, the accumulated Viterbi algorithm branch metrics for the terminal state of each codeword are compared. The terminal state of each codeword is known without ambiguity in the receiver because of the finite-length codewords in the transmitter invention. When the difference between accumulated Viterbi algorithm branch metrics for the upper and lower codeword estimates is small, the codewords may be combined and re-decoded. When the difference in branch metrics is substantial, the decoded codeword with the smaller branch metric sum is propagated as the source bit estimate. In embodiments where the upper and lower sideband codewords are combined when the error metrics are sufficiently similar, the bit estimates which constitute the codeword may be combined (summed) directly or the demodulator samples (e.g. correlation sums determined by matched filtering and sampling) may be combined (summed), and the combined codeword estimate, to be decoded, determined from the combined demodulator samples (information), depending upon the modulation method.

Kumar does not explicitly teach to use a generator matrix to obtain the information word embedded in said decoded codeword as stated in present application.

However, Yonge teaches, in an analogous art, an encoder/decoder scheme for robust transmission of PHY layer frame control information (to support medium access) in OFDM frames (or packets). The PHY layer frame control information to be modulated onto carriers in OFDM symbols is encoded using a product coding to form a product code block or matrix. The product coding is based on a shortened hamming code codeword set having properties of symmetry. Elements of the product code matrix are interleaved so that the elements are modulated onto the carriers of the symbols in diagonal groupings (across time and frequency)

and with some degree of redundancy. The modulated elements are demodulated to produce soft decision values, which are de-interleaved to combine copies of the soft values for elements and re-order the soft values in the order of the elements prior to interleaving. The soft values for each row and each column are provided to a turbo product decoder, which performs a number of iterations of row/column decoding, each iteration applying a weighting to the results to enhance the reliability of the results of each next successive iteration. Upon completion of the final iteration, the decoder applies a hard decision to the soft values to produce a set of hard values for each of the soft values that corresponds to the frame control information. Given the symmetry of the code set, the row/column decoding generates a complete set of correlation values from only a subset of the complete set of correlation values and uses a reduced number of MAP decoding operations to select the best correlation values for each of the soft values. In particular, Yonge teaches (col. 3) to use a generator matrix to obtain the information word embedded in said decoded codeword. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a generator matrix to obtain the information word embedded in said decoded codeword of Yonge with the method and apparatus of Kumar. This modification would have been obvious to one of ordinary skill in the art because one of ordinary skill would have recognized that by having a generator matrix to obtain the information word would have significantly reduced decoding complications.

As per claim 2, Kumar substantially teaches, in view of above rejections, (col. 30) the receiver system combines codeword estimates or selects between decoded codeword by determining a metric which corresponds to the probability of error in each of the decoded codeword estimates, which is performed by way of majority voting.

As per claim 3, Kumar substantially teaches, in view of above rejections, (Figure 4) source message 37 is optionally scrambled by bit scrambler 39. Bit scrambler 39 eliminates long consecutive runs of binary digits zero and one and causes binary digits zero and one to have approximately equal probabilities of occurrence after scrambling. The function of scrambler 39 is used in certain embodiments because certain types of error correction coding, synchronization, and/or equalization methods presume that the transmitted data is approximately random for optimum performance. Scrambler 39 is typically implemented by multiplying source message 37 by certain types of binary polynomials and summing using binary arithmetic.

As per claim 4, Yonge substantially teaches, in view of above rejections, (abstract) elements of the product code matrix are interleaved so that the elements are modulated onto the carriers of the symbols in diagonal groupings (across time and frequency) and with some degree of redundancy. The modulated elements are demodulated to produce soft decision values, which are de-interleaved to combine copies of the soft values for elements and re-order the soft values in the order of the elements prior to interleaving. The soft values for each row and each column are provided to a turbo product decoder, which performs a number of iterations of row/column decoding, each iteration applying a weighting to the results to enhance the reliability of the results of each next successive iteration. Upon completion of the final iteration, the decoder applies a hard decision to the soft values to produce a set of hard values for each of the soft values that corresponds to the frame control information.

As per claims 5-8 and 10, Kumar substantially teaches, in view of above rejections, (cols. 30-31) that for each pair of received codeword estimates, the receiver system combines codeword estimates or selects between decoded codeword by determining a metric which

corresponds to the probability of error in each of the decoded codeword estimates. In certain embodiments, the metric is computed by ECC decoding some or all of the bits for both received codeword estimates and then re-encoding the two decoded estimates to re-generate the pair of ECC codewords. The number of differences in bit positions (i.e. the Hamming distance) between each of the re-encoded estimates and the corresponding received estimate, prior to decoding and re-encoding, is approximately proportional to the bit error rate (BER) for the codeword prior to decoding. When the determined BER estimates for the two codeword estimates are substantially different, the receiver system selects the decoded codeword from the pair with the lower BER (smaller Hamming distance) for propagation as the most probable source bit information for that codeword.

As per claim 11, Kumar substantially teaches a digital data transmission system wherein redundant source bit information is transmitted in both the upper and lower sidebands so that the loss of information in either one but not both sidebands due to large amounts of interference or distortion, caused by, for example, first-adjacent interference, does not deleteriously affect the IBOC DAB receiver performance. The system exhibits both frequency-diversity and time-diversity. The receiver determines which codeword bit estimate, corresponding to either upper or lower sideband signals, is less likely to be erroneous. The receiver system selects between decoded estimates for each pair of demodulated ECC codewords or combines both ECC codeword estimates prior to decoding in certain embodiments. Particularly, Kumar teaches (cols. 30-31) that for each pair of received codeword estimates, the receiver system combines codeword estimates or selects between decoded codeword by determining a metric which corresponds to the probability of error in each of the decoded codeword estimates. In certain

embodiments, the metric is computed by ECC decoding some or all of the bits for both received codeword estimates and then re-encoding the two decoded estimates to re-generate the pair of ECC codewords. The number of differences in bit positions (i.e. the Hamming distance) between each of the re-encoded estimates and the corresponding received estimate, prior to decoding and re-encoding, is approximately proportional to the bit error rate (BER) for the codeword prior to decoding. When the determined BER estimates for the two codeword estimates are substantially different, the receiver system selects the decoded codeword from the pair with the lower BER (smaller Hamming distance) for propagation as the most probable source bit information for that codeword. In certain embodiments of the receiver, when the BER estimate is substantially equal for both codewords in each pair, the codeword estimates are combined in order to increase the signal-to-noise ratio (SNR) since the redundant contributions add approximately coherently and the noise contributions add approximately incoherently. In this circumstance, the combined codeword estimate is then ECC decoded to generate the source bit message estimate for the codeword. Since the error metrics are not determined until after first decoding the upper and lower codewords separately, this requires a second decoding step. In certain embodiments of the invention, instead of determining the error metric by comparing the bit differences between the codeword and re-encoded codeword estimates after ECC decoding, when convolutional encoding is implemented with maximum-likelihood Viterbi decoding, the accumulated Viterbi algorithm branch metrics for the terminal state of each codeword are compared. The terminal state of each codeword is known without ambiguity in the receiver because of the finite-length codewords in the transmitter invention. When the difference between accumulated Viterbi algorithm branch metrics for the upper and lower codeword estimates is small, the codewords

may be combined and re-decoded. When the difference in branch metrics is substantial, the decoded codeword with the smaller branch metric sum is propagated as the source bit estimate. In embodiments where the upper and lower sideband codewords are combined when the error metrics are sufficiently similar, the bit estimates which constitute the codeword may be combined (summed) directly or the demodulator samples (e.g. correlation sums determined by matched filtering and sampling) may be combined (summed), and the combined codeword estimate, to be decoded, determined from the combined demodulator samples (information), depending upon the modulation method.

Kumar does not explicitly teach to use a generator matrix to obtain the information word embedded in said decoded codeword as stated in present application.

However, Yonge teaches, in an analogous art, an encoder/decoder scheme for robust transmission of PHY layer frame control information (to support medium access) in OFDM frames (or packets). The PHY layer frame control information to be modulated onto carriers in OFDM symbols is encoded using a product coding to form a product code block or matrix. The product coding is based on a shortened hamming code codeword set having properties of symmetry. Elements of the product code matrix are interleaved so that the elements are modulated onto the carriers of the symbols in diagonal groupings (across time and frequency) and with some degree of redundancy. The modulated elements are demodulated to produce soft decision values, which are de-interleaved to combine copies of the soft values for elements and re-order the soft values in the order of the elements prior to interleaving. The soft values for each row and each column are provided to a turbo product decoder, which performs a number of iterations of row/column decoding, each iteration applying a weighting to the results to enhance

the reliability of the results of each next successive iteration. Upon completion of the final iteration, the decoder applies a hard decision to the soft values to produce a set of hard values for each of the soft values that corresponds to the frame control information. Given the symmetry of the code set, the row/column decoding generates a complete set of correlation values from only a subset of the complete set of correlation values and uses a reduced number of MAP decoding operations to select the best correlation values for each of the soft values. In particular, Yonge teaches (col. 3) to use a generator matrix to obtain the information word embedded in said decoded codeword. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a generator matrix to obtain the information word embedded in said decoded codeword of Yonge with the method and apparatus of Kumar. This modification would have been obvious to one of ordinary skill in the art because one of ordinary skill would have recognized that by having a generator matrix to obtain the information word would have significantly reduced decoding complications.

As per claim 12, Yonge substantially teaches, in view of above rejections, (col. 22) a computer program residing on a computer-readable medium for encoding data for an OFDM transmission, the computer program comprising instructions.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiries concerning this communication should be directed to the examiner, Mujtaba Chaudry who may be reached at 571-272-3817. The examiner may normally be reached Mon – Thur 6:30 am to 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, please contact the examiner's supervisor, Albert DeCady at 571-272-3819.

Mujtaba Chaudry
Art Unit 2133
May 23, 2006

ALBERT DECADY
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100